

Application No. 10/797,876
Response dated February 18, 2008 to
Non-final Office Action mailed November 16, 2007

REMARKS

Applicants would like to thank the Examiner, Colleen Matthews, for the courtesy afforded in the telephone interview that occurred on February 13, 2008, between Applicants' representatives, Kevin E. Kuehn and Harry J. Guttman, and the Examiner.

I. Rejection under 35 U.S.C. §112 second paragraph

The Examiner rejects claims 1-8, 10-20, and 26 under 35 U.S.C. § 112, second paragraph, as being indefinite. The Applicants have amended claims 1, 20, and 26 to more sharply define the claimed invention. During the interview, it was agreed that claims 1, 20, and 26, which are the independent claims in this group, would be amended to more sharply define "an unreacted portion of the SiGe surface layer." Specifically, it was agreed to amend claims 1, 20, and 26 to more sharply define that the oxide layer is formed by oxidizing a surface portion of the SiGe surface layer. Applicants' representatives suggested that this amendment was supported by the figures, particularly FIGS. 1C and 1D and the specification at paragraph [0019]. The Examiner agreed to withdraw this rejection of the claims in light of the proposed amendment to claims 1, 20, and 26. Applicants believe that no new matter has been added by these amendments. Applicants respectfully request withdrawal of the rejections of these claims.

II. Rejections under 35 U.S.C. §103(a)

Claims 1-3, 13-16, 18-20, and 26 stand rejected under § 103(a) as being unpatentable over Westlinder et al., *Effects of low-temperature water vapor annealing of strained SiGe surface-channel pMOSFETs with high-k dielectric*, European Solid-State Device Research, September 2003, pp. 525-528 ("Westlinder"), in view of Hareland et al. U.S. Patent No. 6,909,151 ("Hareland"). Claims 1, 20, and 26 are independent claims with the remaining claims depending either directly or indirectly from claim 1.

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During the interview, Applicants' representatives and the Examiner briefly discussed Westlinder page 525 at column 1, paragraph 3. For the record, Applicants submit that Westlinder fails to disclose an oxide layer as claimed. Westlinder at page 525, column 1, paragraph 3, refers to "high densities of interface states and oxide charges." Applicants submit that these terms reference the oxides in the high-k dielectric layer or oxidation of the SiGe referred to in the immediately preceding paragraph. Accordingly, Westlinder page 525, column 1, paragraph 3, does not disclose, nor does it suggest, forming the oxide layer as claimed.

Also during the interview, Applicants' representatives noted that the "aforementioned interfacial oxide beneath the high-k dielectric layer" referenced by the Examiner actually refers to an oxide layer formed following deposition of the SiGe layer but prior to the formation of a high-k dielectric layer. The term "aforementioned" refers to a "thin native oxide about 13 Å in thickness." (See page 525, first full paragraph, 5th sentence.) Here, Westlinder states, "The wafers were cleaned in diluted HF and rinsed in de-ionized H₂O prior to ALCVD™ processing, which likely created a thin native oxide about 13 Å in thickness [emphasis added]." Westlinder describes ALCVD processing in a preceding sentence as being used to deposit the high-k gate stack. The "thin native oxide" layer is formed following deposition of the SiGe layer but prior to depositing the high-k layer. Accordingly, the combination of Westlinder in view of Hareland, fails to teach formation of the oxide layer as claimed. Examiner indicated that Applicants review of Westlinder was logical, but would require further review.

Applicants also submit that Westlinder does not suggest to one of ordinary skill in the art that water vapor annealing forms an oxide layer between the SiGe surface layer and the high-k dielectric layer. First, as described above, Westlinder describes that the rinsing step forms the oxide layer; therefore, Westlinder does not suggest forming the oxide layer during the water vapor annealing process. Second, Westlinder describes water vapor treatments of varying duration from no treatment to 210 minutes of exposure. (See Fig. 6 on page 527.) In Fig. 7, the "Annealing time" is plotted versus "normalized oxide capacitance." In the description of Fig. 7

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(third paragraph on page 527), Westlinder describes that the capacitance “is rather constant with annealing time, see Fig. 7, suggesting no reaction has taken place among the materials in the gate stack.” (Emphasis added.) In other words, one of ordinary skill in the art would understand that Westlinder discloses no change in capacitance of the stack following 210 minutes of water vapor annealing of the stack. For these reasons, Applicants submit that the Examiner failed to establish a *prima facie* case of obviousness and respectfully request that the rejection of claims 1, 20, and 26 be withdrawn.

Finally, Westlinder discloses water vapor annealing following deposition of the electrode, not before (see Westlinder, page 525, Section 2). At least for this additional reason, the combination of Westlinder and Hareland does not teach or suggest all the elements of the claimed invention. Applicants respectfully request the rejection of independent claims 1, 20, and 26 be withdrawn.

The Examiner rejects claim 19 under § 103(a) as being unpatentable over Westlinder in view of Hareland. Applicants submit that the Examiner failed to establish a *prima facie* case of obviousness of claim 19 for the reasons set forth above with respect to claim 1. Applicants respectfully request withdrawal of the rejection.

Claims 4-8 stand rejected under § 103(a) as being unpatentable over Westlinder in view of Hareland, and further in view of Hiroshi et al. EP 0684 650 B1 (“Hiroshi”). Claims 4-8 depend either directly or indirectly from claim 1. The Examiner cites Hiroshi as disclosing various gases for forming the SiGe surface layer. Hiroshi does not, however, cure the deficiencies of Westlinder in view of Hareland as set forth above. The Examiner’s combination of Westlinder in view of Hareland in view of Hiroshi, therefore, fails to teach or suggest all of the elements of claims 4-8. Applicants respectfully request that the rejection of claims 4-8 be withdrawn.

Claims 10 and 11 stand rejected under § 103(a) as being unpatentable over Westlinder in view of Hareland and Christiansen et al. U.S. Patent Application Publication No. 2003/0218189 (“Christiansen”). Claims 10 and 11 depend directly from claim 1. Christiansen

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does not cure the deficiencies of Westlinder in view of Hareland as set forth above. Applicants respectfully request that the rejections of claims 10 and 11 be withdrawn.

Claim 17 is rejected under § 103(a) as being unpatentable over Westlinder et al. in view of Hareland et al. and Edwards et al. U.S. Patent No. 5,259,881 (“Edwards”). Claim 17 depends from claim 1. The Examiner cites Edwards for “introducing the substrate into a process chamber of a batch-type processing system.” Edwards does not, however, cure the deficiencies of Westlinder in view of Hareland as set forth above with regard to claims 1, 20, and 26. Applicants respectfully request withdrawal of the rejection of claim 17.

CONCLUSION

In view of the foregoing amendments to the claims and remarks given herein, Applicants respectfully believe this case is in condition for allowance and respectfully request allowance of the pending claims. If the Examiner believes any detailed language of the claims requires further discussion, the Examiner is respectfully asked to telephone the undersigned attorney so that the matter may be promptly resolved. The Examiner's prompt attention to this matter is appreciated.

The non-final Office Action was mailed on November 16, 2007, setting a 3-month shortened statutory period for reply. The 3-month period ended February 16, 2008, which falls on a Saturday. This response was filed on the following Monday, February 18, 2008; therefore, it is believed to be timely such that no extension fees are due.

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Applicants are of the opinion that no fee is due as a result of this Amendment. If any charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000. Payment of all charges due for this filing is made on the attached Electronic Fee Sheet. If any additional charges or credits are necessary to complete this communication, please apply them to Deposit Account No. 23-3000.

Respectfully submitted,
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